"Deciphering Microtubule-Based Positioning Strategies in Vitro"

by

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Abstract:

The interplay between dynamic microtubules (MTs) and dynein motor proteins at the cortex plays an important role in many cellular positioning processes. We address the mechanism of the MT-dynein interaction in an in vitro assay in which dynamic MTs interact with microfabricated barriers coated with purified dynein. Using optical tweezers, we show that the interaction between dynein and shrinking MTs can generate pulling forces up to ~5 pN. Subsequently, MT asters are grown in microfabricated chambers with dynein attached to the chamber walls. MTs that grow against the chamber walls and are not captured by dynein, generate pushing forces. Pulling forces are generated by shrinking MTs that interact with dynein. We find that MT asters center more reliably in microfabricated chambers by a combination of pulling and pushing forces than by pushing forces alone. This result is supported by a theoretical model. To understand the potential role of membrane flexibility and the mobility of dynein at the cortex, we are currently repeating these experiments in emulsion droplets and vesicles.

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